Structured Electronic Design
Frequency Compensation:
the Phantom Zero

Phantom zeros

Phantom zeros

Design of the characteristic polynomial of the servo function

Phantom zeros

Design of the characteristic polynomial of the servo function

$$S(s) = \frac{-L(s)}{1-L(s)} = \frac{-L_{\mathrm{DC}}N(s)}{D(s)-L_{\mathrm{DC}}N(s)}$$

Phantom zeros

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Characteristic polynomial of the servo function

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$$D(s) - L_{\mathrm{DC}}N(s) = 0$$

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Loop gain with n poles:

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Loop gain with n poles:

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Loop gain with n poles:

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Loop gain with n poles:

1. Loop gain-poles product defines the coefficient of the highest order of s
2. n-1 zeros can be inserted in the loop to adjust the other coefficients to those of desired filter characteristic
3. Those zeros are also zeros in the servo function

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$$A_f(s) = A_{f\infty}(s) \frac{-L(s)}{1-L(s)}$$

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$$A_f(s) = A_{f\infty}(s)\ \frac{-L(s)(1-s/z_1)}{1-L(s)(1-s/z_1)} \longleftarrow$$ Zero in loop gain appears in servo function

Zero changes characteristic equation and thus the poles of the servo function

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